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GUIDE FOR PREPARATION OF THE PRELIMINARY ENGINEERING REPORT AND CONSTRUCTION PLANS

The preliminary engineering report is normally the only engineering report required by USDA Rural Utilities Service (RUS). It establishes the PROJECT SCOPE, FUNDING REQUIREMENTS, and outlines the BASIC PROJECT DESIGN. It should be submitted together with the environmental report. Any changes in the proposed project after approval of the preliminary engineering report will require an amendment be provided by the applicant's engineer for USDA Rural Development review and approval. The project as proposed should meet the requirements of the Texas Commission on Environmental Quality (TCEQ).

Use RUS Bulletins 1780-2, 1780-3, 1780-3, 1780-4, and 1780-5. In addition to the appropriate bulletins, the reports should include the following information:

BASIC INFORMATION REQUIRED

- A. Water Systems
- B. Sewer Systems
- C. Solid Waste Disposal Systems/Collection
- D. Storm Waste – Waste Disposal

A. Water Systems

1. System Plan Map should include the following:
 - a. Scale, 1" = 2000' for rural type water systems. For urban systems this scale may need to be 1" = 1000' to 1" = 500'. All information must be clearly shown and legible.
 - b. Topographic information in the form of contour lines with critical elevations shown, such as at: plant sites, elevated tanks, wells, 100- year and 500-year floodplain, etc.
 - c. Meter Distribution. Distinguish between residential and commercial and wet and dry taps. New meters should be identified by number and referenced to a member list for water supply corporations.
 - d. Location of all existing and proposed lines with their respective diameters clearly shown. Proposed lines should be highlighted.
 - e. Location of all plants, wells, control valves, etc., should be included.
 - f. Plant service area boundaries should be shown and operating and static pressure provided in feet MSL.
 - g. Hydraulic Computation Nodes should be shown.
 - h. Highlight known low pressure areas and potential low pressure areas as identified from the hydraulic analysis of the existing system.

2. Hydraulic Computations should include:

In table form; head loss calculations for each connection, number of connections, flow in gallons per minute (gpm), distance in feet, diameter of pipe in inches, head loss in feet/100, frictional head loss between connections, cumulative head loss from source to connection, elevation of each connection, operating and static head at each connection and a “Remarks” column to show location of in-line or individual pressure controls, etc. An explanation of tabulated data should accompany tables and should include appropriate friction factors used. For extension of existing systems, the analysis should begin back at the supply source.

- a. Analysis of existing system at 1.0 gpm per meter. This should identify potential low pressure areas.
 - b. Analysis of system with proposed improvements at 1.5 gpm. This should provide basic design and sizing of system to meet Texas Commission on Environmental Quality (TCEQ) and USDA Rural Utilities Service requirements.
 - c. Analysis at static conditions. This should establish pressure pipe classification requirements and locations of pressure reducing stations.
3. Historic growth data and curve. This should be obtained from actual growth data of the system.
4. Water loss accounting data shall be provided for the most recent 12 month period. Data should be presented in table form and include the volume of water pumped or purchased, water sold, and percent of water loss for each month. Water loss should not normally exceed 15 percent.
5. Analysis of existing facilities with respect to TCEQ requirements to include: supply (well), ground storage, elevated storage, high service pump capacity, and pressure tanks. Proposed facilities must comply with TCEQ requirements.
6. The evaluation of a well for water supply shall include:
- a. A chemical analysis of the nearest well in the formation to be developed.
 - b. A comparison of the analysis with Texas Commission on Environmental Quality (TCEQ) Standards.
 - c. The name of the formation and proposed well depth.
 - d. Basic ground water hydrology in the area and of the formation to be developed.
 - e. Location of the proposed well with respect to existing wells in the area.

7. Information shall be provided for each plant (pump station, elevated tank, standpipe, etc.) to include:
 - a. Number of meters provided direct service and number of meters provided indirect service.
 - b. Pump capacity (actual and TCEQ requirement).
 - c. Pressure tank capacity (actual and TCEQ requirement).
 - d. Ground storage tank capacity (actual and TCEQ requirement).
 - e. Elevated storage capacity (actual and TCEQ requirement).
 - f. Standpipe capacity, dimensions, and capacity above 35 psi with respect to the highest meter.
 - g. Static pressure of plant service area in feet Mean Sea Level. For hydro-pneumatic plants this would be the cut-off pressure; for standpipes/elevated tanks, it would be the overflow elevation.
 - h. Supply available to plant and supply required by TCEQ.
8. Water system/treatment design alternatives.
9. Detailed cost estimate to include unit cost of all pipe, valves, road crossings, stream crossings and all distribution system appurtenances as it will appear in the bid schedule. Estimated cost of wells and plant work should also be broken into components. A contingency not to exceed 10% of construction cost should be included. Engineering costs should be separated as it is in the Agreement for Engineering Services. Other costs should be included such as: interest during construction, land, legal, water rights, etc. Administrative cost should not be included in the proposed USDA Rural Utilities Service funding requirements.
10. Funding from USDA Rural Utilities Service, State agencies, and other funding sources **MUST** be clearly distinguished in the detailed cost estimate.
11. The report must demonstrate that the proposed project complies with USDA Rural Utilities Service Instructions. RUS Instruction 1780, Subpart 1780.10, provides that loan and grant funds may not be used to finance facilities which are not modest in size, design, and cost.
12. Annual Operating Budget. The report should contain the annual operating cost, as well as a typical operating budget. The budget should include principal and interest on loan, power cost, water cost if purchased, maintenance, labor, taxes, insurance, audits, equipment leased, reserves, and other costs. Short lived assets must also be addressed. The minimum annual reserve payment must be equal to 1/10 of the annual payment. Short lived assets must also be addressed to include items typically not found in O & M expenses that need to be replaced over 1 to 15 years. Avoid including dry taps in calculating income from water sales and livestock water meters, unless no other livestock water supply will be available. The budget should be prepared on Form RD 442-7, "Operating Budget," in consultation with the applicant and USDA Rural Development local office

personnel. The income from dry taps should be shown on a separate line and not be included in the feasibility of the project. Include all taxes for State, County, schools, etc.

B. Sewer Systems

Life cycle cost analysis for the wastewater collection and treatment facilities should always be provided.

1. Collection System Plan Map must include the following:
 - a. Scale, 1" = 400' or less for small town type sewer systems.
 - b. Topographic information must be more detailed than for water systems. Contours at one (1) or two (2) foot intervals is normally needed for a good preliminary layout of sewer collection lines.
 - c. Tap Locations. Tap locations should be shown with respect to the house and business to be served. Distinguish between residential and commercial taps.
 - d. Manhole locations with number designation and clean-outs should be shown and numbered.
 - e. Location of all lines with respective diameters.
 - f. Location of all lift stations.
2. Treatment Plant Layout Map should show the following:
 - a. Property boundaries.
 - b. Facilities locations and dimensions.
 - c. Outfall line and point of discharge.
 - d. Contour lines.
 - e. Buffer zone limits.
 - f. Adjacent property owner identification and any residential type structures in the vicinity of the treatment plant.
3. Historic growth and growth curve projection based on the actual number of connections should be included.
4. Facility sizing and design: Proposed facilities sizing and design should be shown with respect to TCEQ requirements. Consideration of treatment facility design shall be based on permit requirements. It will consider cost-effective project development, economy of operation, required operator skills, and human resources of rural community. Presented will be:
 - a. Plant sizing with respect to design population and flow estimates.
 - b. Lift station component sizing with wet well dimensions and capacity (showing

design calculations for sizing), number of sewer taps to be served and pump capacity and head requirements (show design calculations for sizing).

- c. Hydraulic computations will be required on all force mains.
- d. For gravity lines; grades, diameter, and velocities should be presented in table form by line segments. A table should also be presented giving manhole numbers, proposed flow line elevations, and depth of manhole. Within the text of the report, a discussion should be presented on the results of the computation.

Design of the sewer collection system shall consider:

- Utilization of water tight manholes and collection lines.
 - Reduction of the number of manholes required and maximum utilization of cleanouts.
 - Innovative alternatives to reduce construction costs while considering operating and maintenance (O&M) costs.
- e. Treatment Facility Design Alternatives. For small cities and rural towns, treatment considered must include alternatives such as:
 - Facultative/oxidation ponds with discharge permit.
 - Facultative/oxidation ponds with irrigation and a seasonal discharge permit.
 - Facultative/oxidation ponds with irrigation and no discharge permit.
 - Facultative/oxidation ponds with final effluent polishing by rockweed filter, artificial marsh, artificial wetland, overland flow, etc., and a discharge permit.
 - or other systems as may be suggested by the engineer.
- 5. Establish need for proposed facilities and improvements.
 - 6. Detailed cost estimate to include unit cost of collection system pipe by diameter and depth. Depth increments should be 0 – 5', 5' – 7', 7' – 9', etc. Estimated cost of plant work should be broken into components. A contingency not to exceed 10% of construction cost should be included. Engineering costs should be separated as it is in the Agreement for Engineering Services. Other costs should be included, such as: interest during construction, land, legal, water rights, etc. Administrative cost should not be included in the proposed USDA Rural Utilities Service funding requirements.
 - 7. Funding from USDA Rural Utilities Service, State, and other funding sources MUST be clearly distinguished in the detailed cost estimate.

8. The report must demonstrate that the proposed project complies with USDA Rural Utilities Service Instructions. RUS Instruction 1780, Subpart 1780.10, provides that loan and grant funds may not be used to finance facilities which are not modest in size, design, and cost.
9. Annual Operating Budget. Information as described in paragraph A. 12. should be provided.

C. Solid Waste Disposal Systems/Collection. The design will describe the process in detail and identify quantities of material, length of transport, and any special handling requirements. It also must describe equipment required and plans for equipment location. Type of storage, if any, size and site location must be identified. The process of disposal should be described in detail and identify permit requirements, quantities of material, recycling process, location of plant and site of any process discharges. The report should also include an Annual Operating Budget as described in paragraph A. 12.

D. Storm Waste – Water Disposal.

1. Collection Design. Collection design will identify general location of the improvements; lengths, sizes and key components.
2. Pumping Stations. Size, type, site location and any special power requirements shall be identified.
3. Storage. Size, type and site location must be identified.
4. Treatment. If required, the process should be described in detail and identify location of plant site of any process discharges in addition to storm water.
5. Hydraulic Calculations. Hydraulic calculations in sufficient detail in a tabular format/computer printout shall also be provided. This should include a map with a list of inlets and pipes and the associated characteristics, such as elevation of inverts, pipe diameter, pipe segment length, reservoir elevation, etc.
6. Annual Operating Budget should be included.

CONSTRUCTION CONTRACTS, PLANS & SPECIFICATIONS

- (a) Contract Documents – see TX-RUS Instruction 1780-C, Appendix A, "Rural Utilities Service Water and/or Waste Assembly of Contract Documents," or "Assembly of Contract Documents for Short Form Construction Contract."

If using the EJCDC contract documents, see TX-RUS Instruction 1780-C, Appendix B, “Assembly of EJCDC Contract Documents, Funding Agency Edition.”

(b) Construction Plans. The construction plans should contain the following information:

1. Title Sheet.

- a. Name of project, counties, state, etc.
- b. Board of Directors or Public Officials.
- c. Seal of Engineer with signature and date.
- d. Date of latest revision.

2. Key Map.

- a. Include a key map of the project showing the roads, towns, communities, water lines, storage tanks, pumping stations, wells, etc. If the area to be served is shown on two or more sheets, the key map supplied should show by sheet number the area covered by the various sheets.
- b. General notes to the contractor.
- c. Legend.

3. Pipeline Construction Plans.

- a. Scales should be approximately 1 inch to 200 feet, to 1 inch to 400 feet. Larger scales should be used where needed.
- b. Maps should be approximately 24 inches by 36 inches in size. Smaller sized legible maps are also acceptable.
- c. North arrow and scale should be shown on each sheet and arranged so that North is pointed to the top of the sheet.
- d. The plan map should include location of the pipeline, meters, sewer service taps, water source, pumping plants, storage facilities, easements, roads, fences, culverts, other pipelines, underground cables, creeks or rivers, bridges, names of roads or highway numbers, and construction hazards.
- e. The customer’s name, location and elevations.
- f. The location of in-line pressure reducing valves and outlet pressure setting.
- g. Highway crossing, length, size, and type of encasement.
- h. Location and size of all proposed pipelines, valves, markers, etc.
- i. Use enlarged “insets” to show location of valves, line junctions, or other special appurtenances.
- j. Elevations should be shown at the wells, plants, storage facilities, pressure regulators, intersections, changes in pipe sizes, ends of lines, junctions of laterals, and high and low parts of the line.

- k. A system of grid plan mapping should be used and strip mapping avoided on rural water systems.

4. Construction Detail Plans. These plans should include:

- a. Plant layout showing:
 - (1) Plat of the site with orientation, topography, dimensions, drainage, existing easements (power, gas, etc), piping and valve arrangement, buildings, wells, storage tank, fences, gates, master meters, floor drain outlets, etc.
 - (2) Flow through diagrams of the plant.
 - (3) Construction details of all structures such as foundations, retainer rings, splash blocks, drainage, roads, buildings, piping, electrical, heating, sanitary structures, storage tanks, water treatment facilities, wells, backwash pits, building ventilation and pressure tanks.
- b. Plan views and individual details of storage tank or elevated tank. The supply line to the storage tank should discharge above high water. The storage tank should be set on a layer of clean gravel. A retainer ring should be installed around the ground storage tank approximately 2 feet larger than the diameter of the tank. Reinforced concrete foundations will be needed for standpipes and elevated tanks. Where a well is discharging into the tank, show the location of the electrode on/off and emergency off settings.
- c. The spacing and size of reinforced steel in concrete footing, foundations, and walls.
- d. Elevation and plan views of buildings and plant piping orientated with respect to plant layout.
- e. Include other details, drawings, specifications and dimensions adequate for construction.

5. Standard Detail Sheet. Include all dimensions, sizes, specifications, and details as needed. The standard detail sheet should include details for:

- a. Blow-off valve.
- b. Regulator valve and meter installation.
- c. Creek or river crossings.
- d. Railroad, road and highway crossings.
- e. Pipe installation and bedding.
- f. Standard valve installation for various types of pipe material by pipe and valve size.

- g. Air relief valves or vents. These should be located in right-of-way fence lines, or other protected location in non-traffic areas.
 - h. Flush valves – discharge should be 18 inches above ground and located in fence lines or on right-of-way.
 - i. Service tap for various types of materials.
 - j. Meter or valve vaults, boxes, etc.
 - k. Concrete thrust blocks.
 - l. Fire hydrant.
 - m. Standard service loop and meter.
 - n. Chain link or other fencing.
 - o. Pipeline and valve markers.
 - p. Short and long-side service wye.
 - q. Manhole details.
 - r. Clean out details.
 - s. Cathodic protection, if other means of corrosion protection are not specified.
6. All plan sheets shall bear the seal and signature of the designing engineer and date of execution.
7. Environmental Mitigation. Mitigation requirements as stated in the approved environmental report and the Letter of Conditions shall be incorporated by the *engineer in the contract documents, plans and specifications.*